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(54) Isolation fasteners

(57) An isolation fastener (14) for securing one structural part (10) to another (12) in such a way as to reduce transmission of vibration and sound from one part to the other comprises, in combination, fastening means (22, 24, 26, 28) for securing the parts to each other and interposable elastomeric elements (30, 32) designed to be disposed between the parts and about the fastening means.

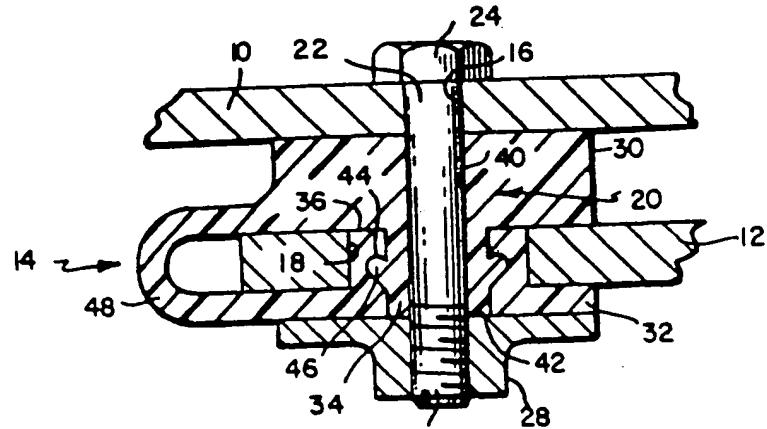


FIG. 1

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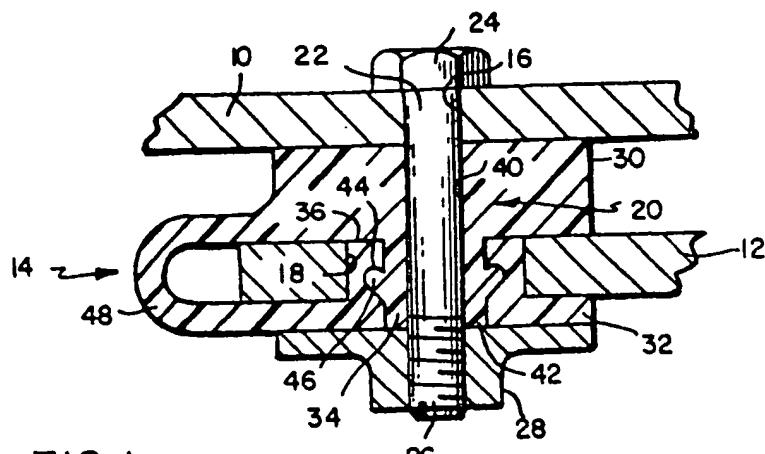


FIG. 1

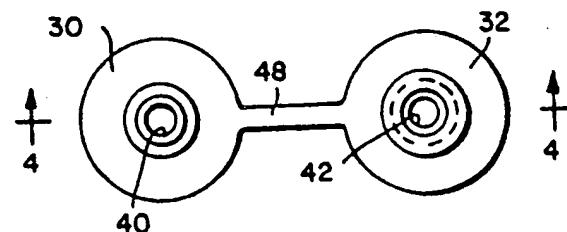


FIG. 3

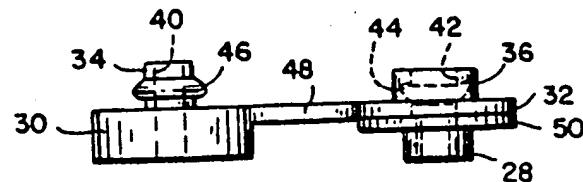


FIG. 2

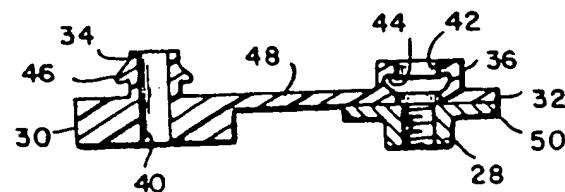


FIG. 4

## SPECIFICATION

## Isolation fasteners

## 5 This invention relates to isolation fasteners.

In the aircraft industry, there is a need for securing the interior wall, ceiling and floor panels comprising the fuselage to the frame of the aircraft in such a way as to reduce transfer of vibration and noise from the 10 frame to the component parts of the fuselage. Heretofore, this was accomplished by employing a "noise-absorbing" mat and a floating nut attached to the frame with spring clips. The disadvantages of that means for attaching the component parts of the 15 fuselage to the frame are that the noise-absorbing mat absorbs moisture, mildews, absorbs and transmits odors and thus requires that it be continually replaced. It is an object of this invention to provide a replacement for the aforesaid noise-absorbing mat 20 and floating nut plate which replacement can provide improved vibration and noise isolation, require little or no maintenance or replacement, simplify installation, be fail-safe and not be subject to deterioration, molding and/or a source of unpleasant 25 odor.

As herein illustrated, a device embodying this invention is a combination fastener/isolator designed to secure two parts in spaced relation in such a way as to minimize the transmission of vibration 30 and noise from one part to the other. The two parts contain, for this purpose, aligned holes and the device comprises, in combination, an element adapted to be inserted through the holes with retaining means at its opposite ends and an inter- 35 posable elastomeric system comprising an elastomer body disposed about the portion of the element between the parts, an elastomeric body disposed about the element between the retaining means at one end and the part confronting the retaining 40 means and elastomeric protrusions extending from the respective bodies into the hole about the portion of the element extending through the hole in the part embraced between the elastomeric bodies. Specifically, one of the parts is a supporting structure, for 45 example, the frame of an aircraft, and the other part is a wall, ceiling or floor panel which desirably is to be attached thereto and to be isolated therefrom for both vibration and noise. The connecting element is a bolt with a head at one end and a nut at the other 50 end, the hole in the supporting structure is of larger cross section than that of the bolt and the protrusions extend from the respective bodies into the hole of larger diameter about the portion of the bolt extending therethrough. One of the protrusions is of 55 a diameter to fit within the hole of larger diameter and contains a hole within which the protrusion from the other body fits and the latter protrusion has a hole of a diameter to receive the bolt. There are means at the interfaces of the protrusions for locking 60 them in telescoping engagement.

As an item of manufacture, the isolation fastener comprises spaced, flexibly-connected elastomeric bodies having surfaces in a common plane and protrusions extending from said surfaces, said protrusions containing holes, the area of which are

perpendicular to said common plane, the hole in one body being of a cross section to receive the other protrusion. A threaded nut is affixed to the one body in concentric relation to the hole therein. The hole in

70 the other body corresponds in diameter to the threaded hole in the nut. The isolation fastener includes a rigid bolt adapted to be inserted through the holes in the bodies and screwed into the nut. The protrusions are provided with interengageable 75 means for locking them in telescoping engagement.

According to a first aspect of the invention, there is provided:

An isolation fastener for reducing transmission of vibration and noise from one part to another where- 80 in the parts contain aligned holes comprising, in combination, an element adapted to be inserted through the holes with retaining means at its ends and an interposable elastomeric system comprising an elastomeric body disposed about the portion of 85 the element between the parts, an elastomeric body disposed about the element between the retaining means at one end and the part confronted by the retaining means and elastomeric protrusions ex- 90 tending from the respective bodies into the hole about the portion of the element extending through the hole in the part embraced between the elastomeric bodies.

According to a second aspect of the invention, there is provided:

95 An isolation fastener assembly for securing two parts together in spaced relation comprising, in combination, a rigid connector element adapted to be inserted through aligned holes in the two parts with a head at one end and a nut at the other and an 100 interposable elastomeric comprising an elastomeric body disposed between the parts about the bolt, an elastomeric body disposed between the nut and one of said elastomeric bodies about the bolt and elastomeric protrusions extending from the respec- 105 tive elastomeric bodies into the hole in the one of the parts about the portion of the bolt therein.

According to a third aspect of the invention, there is provided:

An isolation fastener for securing two parts 110 together, one of which is a support structure and the other a structure to be isolated therefrom comprising, in combination, a rigid bolt having a head at one end and a nut at the other end adapted to be inserted through the holes with the head engaged with the 115 structure to be isolated and an interposable elastomeric system comprising an elastomeric body disposed between the structures about the bolt, an elastomeric body disposed between the nut and the support structure, and elastomeric protrusions ex- 120 tending from the respective bodies into the holes in the support structure about the bolt therein.

According to a fourth aspect of the invention, there is provided:

An isolation fastener comprising, in combination, 125 spaced, flexibly-connected elastomeric bodies hav- ing a surface in a common plane and protrusions extending from said plane, said bodies and protrusions containing aligned holes, the axes of which are perpendicular to said plane, the hole in one protru- 130 sion being of a cross section to receive the other

protrusion, a threaded nut affixed to the body containing the hole adapted to receive the protrusion in concentric relation to the hole therein, a hole in the other body corresponding in diameter to the 5 threaded hole in the nut and a rigid bolt adapted to be inserted through the holes in the bodies and screwed into the nut.

According to a fifth aspect of the invention, there is provided:

10 An isolation fastener comprising spaced, elastomeric bodies containing holes, each elastomeric body being provided with protrusions at one side and each protrusion containing a hole in alignment with the body from which it protrudes, the hole in 15 the protrusion from one body being of a size to telescopically receive the protrusion from the other body, elastomeric means connecting the two bodies so that the bodies may be arranged in superimposed relation to each other with the protrusion of the one 20 body engaged within the protrusion of the other body, a nut secured to the one body in concentric relation to the hole therein and a bolt adapted to be inserted through the hole in the one body and its protrusion and screwed into the nut attached to the 25 other body.

According to a sixth aspect of the invention, there is provided:

A system for securing parts in isolation from each other comprising a support structure and a structure 30 to be isolated therefrom comprising, in combination, bolts provided with heads at one end and nuts at the other end adapted to be inserted through aligned holes in the structures, the holes in the support structure being of larger diameter than the bolts and 35 interposing elastomeric structures each comprising an elastomeric body disposed about the portion of the bolt between the parts, an elastomeric body disposed about the part between the nut and the part confronted thereby and elastomeric protrusions 40 tending from the respective bodies into and filling the hole of larger diameter about the portion of the bolt extending therethrough.

According to a seventh aspect of the invention, there is provided:

45 A system for securing parts in isolation from each other comprising providing holes in the parts in alignment, with one hole larger than the other, inserting a fastening element through the holes in the form of a bolt having a head at one end and a nut 50 at the other end, interposing an elastomeric body between the parts about the bolt, interposing an elastomeric body between the nut and the part it confronts and interposing an elastomeric body within the hole of larger diameter about the bolt 55 extending therethrough.

According to an eighth aspect of the invention, there is provided:

A method for securing parts together in isolation from each other comprising forming aligned holes in 60 the parts, one of which is of larger diameter than the other, inserting a bolt provided with a head at one end and a nut at the other end through the aligned holes and interposing elastomeric bodies between the parts, about the bolt between the nut and the 65 part it confronts and in the hole of larger diameter

about the bolt extending therethrough.

According to a ninth aspect of the invention, there is provided:

A method of isolating one structural part from 70 another wherein the other structural part is a supporting structure comprising providing aligned holes in the parts, the holes in the supporting structure being of larger diameter than the holes in the supported structure, inserting holes through the 75 aligned holes, said bolts being provided with heads at one end for engagement with the supported structure and nuts at the other end and interposing elastomeric bodies between the structures about the bolt, between the nuts and the support structure, 80 and in the holes of larger diameter in the support structure about the portions of the bolts extending therethrough.

The invention also includes a method for securing parts in isolation from each other comprising providing aligned holes in the parts, one of which of each pair of holes is of larger diameter than the other, inserting bolts through the aligned holes provided with heads at one end and nuts at the other end and interposing elastomeric bodies between the parts 85 90 about the bolt between the nuts and the part it confronts and in the enlarged holes about the portions of the bolts extending therethrough.

By way of example only, an illustrative embodiment of the invention will now be described with 95 reference to the accompanying drawing, in which:

*Figure 1* is a fragmentary view partly in section showing a sectional portion of, for example, a wall panel attached to a sectional portion of, for example, the supporting frame of an airplane with a combination fastener and isolator embodying this invention;

*Figure 2* is an elevation of the combination fastener and isolator as an item of manufacture before installation;

*Figure 3* is a top plan of *Figure 2*; and

*Figure 4* is a section taken on the line 4-4 of *Figure 3*.

Referring to *Figure 1* of the drawings, there is shown a portion 10 of a wall, ceiling or floor panel of the fuselage of an airplane secured to supporting structure 12 which can be part of the airplane frame by means of an isolator/fastener device 14 which embodies this invention. It is to be understood, however, that the part 10 can be any structure which is desirably supported from a structure 12 in such a manner as to reduce transmission of vibration and sound from the structure 12 to the structure 10 and so the device 14 is not limited in its use to airplane manufacturing.

For fastening of the two parts 10 and 12 will be referred to as the isolated or supported structure and the supporting structure, respectively, there are provided aligned holes 16 and 18 for receiving a fastening element 20 in the form of a bolt provided with a shank portion 22, a head 24 and a threaded end 26 adapted to receive a nut 28. The hole 16 in the isolated or supported structure corresponds in diameter to the shank of the bolt and the hole 18 in the support structure is of larger diameter than the shank of the bolt.

130 The isolator component of the isolation fastener

14 comprises an elastomeric body 30 disposed between the opposed surfaces of the supported structure and the support structure about the shank 22 of the bolt, an elastomeric body 32 disposed 5 between the nut 28 and the support structure 12 about the shank of the bolt and elastomeric protrusions 34 and 36 extending from their respective elastomeric bodies 30 and 32 into the hole 18 about the portion of the shank 22 extending through the 10 hole 18. The elastomeric body 30 and its protrusion 34 contain a hole 40 of a diameter to receive the shank of the bolt and the protrusion has an outside diameter which is less than the inside diameter of the hole 18. The elastomeric body 32 and its 15 protrusion 36 contain an opening 42 of a diameter to receive the protrusion 34 and the protrusion itself is of an outside diameter to fit closely into the hole 18. At the interfaces of the two protrusions 34 and 36, there are, respectively, an annular groove 44 and a 20 lip 46 which are interengaged and hold the protrusions in telescoping relation to each other. The nut 28 is screwed onto the threaded portion of the bolt against the body 32. As thus assembled, the bolt, while securing the two parts together, is isolated 25 from the support structure 12 so that there is no rigid component between the support structure and the bolt for transmitting vibration or noise from the support structure to the supported structure.

The isolator component of the isolator fastener is 30 shown prior to its installation in Figures 2, 3 and 4 wherein the elastomeric body 30 is of circular cross section, the elastomeric body 32 is of circular cross section and the two bodies 30 and 32 are connected by a linking elastomeric body 48. The upper surface 35 of the bodies 30 and 32 are situated in a common plane and each of the bodies 30 and 32 has at its geometric center a protrusion 34 and 36, respectively. The protrusions 34 and 36 extend upwardly from the bodies 30 and 32 and are of circular cross 40 section. The holes 40 and 42 extend through the body portions 30 and 32 and their extensions 34 and 36. The protrusions are integral portions of the bodies 30 and 32 and the groove 44 and lip 46 are formed as a part thereof. The nut 28 is provided with 45 a flange 50 by means of which it is attached to the body 32.

As thus constructed, the body 30 is flexibly connected to the body 32 so that it may be disposed in superimposed relation with the body 32 by folding 50 of the linking connection 48 and applied to the supporting structure by interengaging the telescoping protrusions 34 and 36. It then becomes a relatively simple matter to mount the supported structure on the elastomeric body 30, align the hole 55 16 therein with the hole 18 in the elastomeric body 32, insert a bolt 24 therethrough and through the protrusions into the nut 28 which is supported at the lower side of the support structure by the isolator and so does not require access to the underside of 60 the support structure for making an installation.

The combination device as described is inexpensive to manufacture, easy to install, an excellent insulator for preventing transmission of noise and vibration and is not susceptible to deterioration nor 65 the absorption of moisture or odors which would

require replacement.

Modifications of the illustrated fastener are possible within the scope of the appended claims.

## 70 CLAIMS

1. An isolation fastener for reducing transmission of vibration and noise from one part to another wherein the parts contain aligned holes comprising, 75 in combination, an element adapted to be inserted through the holes with retaining means at its ends and an interposable elastomeric system comprising an elastomeric body disposed about the portion of the element between the parts, an elastomeric body 80 disposed about the element between the retaining means at one end and the part confronted by the retaining means and elastomeric protrusions extending from the respective bodies into the hole about the portion of the element extending through 85 the hole in the part embraced between the elastomeric bodies.
2. An isolation fastener according to claim 1 wherein one of the parts is a support structure and the other part a structure to be isolated from the 90 support structure and wherein the hole in the support structure is of larger cross section than that of said element and the protrusions extending from the respective parts extend into the hole of larger cross section about the portion of said element 95 therein.
3. An isolation fastener according to claim 1 or 2 wherein the protrusions embody means interlocking one with the other.
4. An isolation fastener according to any preceding 100 claim wherein one of the protrusions contains a hole corresponding in cross section to said element for receiving said element, the other a hole corresponding in cross section to the one protrusion for receiving said one protrusion and an outside cross 105 section corresponding to the cross section of the hole, and interengageable means at the interfaces of the protrusions for locking them to each other within the hole.
5. An isolation fastener according to any preceding 110 claim wherein said element is a bolt and the retaining means are a head at one end and a nut at the other end.
6. An isolation fastener according to claim 5 wherein the nut is affixed to one of said elastomeric bodies. 115
7. An isolation fastener according to any preceding claim wherein there is elastomeric means connecting the two elastomeric bodies.
8. An isolation fastener according to claim 5 or 6 120 or claim 7 as dependent on claim 5 wherein the elastomeric body disposed about the portion of the bolt between the parts and its protrusion contains a hole of a cross section corresponding to the bolt for receiving the bolt and the elastomeric body disposed 125 about the portion of the bolt between the nut and the part confronted by the nut and its protrusion contains a hole of a cross section to receive the protrusion from the body disposed between the parts.
9. An isolation fastener assembly for securing 130

two parts together in spaced relation comprising, in combination, a rigid connector element adapted to be inserted through aligned holes in the two parts with a head at one end and a nut at the other and an interposable elastomeric comprising an elastomeric body disposed between the parts about the bolt, an elastomeric body disposed between the nut and one of said elastomeric bodies about the bolt and elastomeric protrusions extending from the respective elastomeric bodies into the hole in one of the parts about the portion of the bolt therein.

10. An isolation fastener for securing two parts together, one of which is a support structure and the other a structure to be isolated therefrom comprising, in combination, a rigid bolt having a head at one end and a nut at the other end adapted to be inserted through the holes with the head engaged with the structure to be isolated and an interposable elastomeric system comprising an elastomeric body disposed between the structures about the bolt, an elastomeric body disposed between the nut and the support structure, and elastomeric protrusions extending from the respective bodies into the holes in the support structure about the bolt therein.

15. 11. An isolation fastener comprising, in combination, spaced, flexibly-connected elastomeric bodies having a surface in a common plane and protrusions extending from said plane, said bodies and protrusions containing aligned holes, the axes of which are perpendicular to said plane, the hole in one protrusion being of a cross section to receive the other protrusion, a threaded nut affixed to the body containing the hole adapted to receive the protrusion in concentric relation to the hole therein, a hole in the other body corresponding in diameter to the threaded hole in the nut and a rigid bolt adapted to be inserted through the holes in the bodies and screwed into the nut.

20. 12. An isolation fastener according to claim 11 wherein the protrusions are provided with interengagable means for locking the protrusions of the one body within the protrusions of the other body.

25. 13. An isolation fastener comprising spaced, elastomeric bodies containing holes, each elastomeric body being provided with protrusions at one side and each protrusion containing a hole in alignment with the body from which it protrudes, the hole in the protrusion from one body being of a size to telescopically receive the protrusion from the other body, elastomeric means connecting the two bodies so that the bodies may be arranged in superimposed relation to each other with the protrusion of the one body engaged within the protrusion of the other body, a nut secured to the one body in concentric relation to the hole therein and a bolt adapted to be inserted through the hole in the one body and its protrusion and screwed into the nut attached to the other body.

30. 14. An isolation fastener according to claim 13 wherein there is means internally of the hole in one protrusion and externally of the protrusion of the other body adapted to be interengaged.

35. 15. An isolation fastener according to claim 14 wherein said means comprise a groove internally of one protrusion and a lip externally of the other

protrusion.

16. A system for securing parts in isolation from each other comprising a support structure and a structure to be isolated therefrom comprising, in combination, bolts provided with heads at one end and nuts at the other end adapted to be inserted through aligned holes in the structures, the holes in the support structure being of larger diameter than the bolts and interposing elastomeric structures each comprising an elastomeric body disposed about the portion of the bolt between the parts, an elastomeric body disposed about the part between the nut and the part confronted thereby and elastomeric protrusions extending from the respective bodies into and filling the hole of larger diameter about the portion of the bolt extending therethrough.

17. A system for securing parts in isolation from each other comprising providing holes in the parts in alignment, with one hole larger than the other, inserting a fastening element through the holes in the form of a bolt having a head at one end and a nut at the other end, interposing an elastomeric body between the parts about the bolt, interposing an elastomeric body between the nut and the part it confronts and interposing an elastomeric body within the hole of larger diameter about the bolt extending therethrough.

18. A method for securing parts together in isolation from each other comprising forming aligned holes in the parts, one of which is of larger diameter than the other, inserting a bolt provided with a head at one end and a nut at the other end through the aligned holes and interposing elastomeric bodies between the parts, about the bolt between the nut and the part it confronts and in the hole of larger diameter about the bolt extending therethrough.

19. A method of isolating one structural part from another wherein the other structural part is a supporting structure comprising providing aligned holes in the parts, the holes in the supporting structure being of larger diameter than the holes in the supported structure, inserting holes through the aligned holes, said bolts being provided with heads at one end for engagement with the supported structure and nuts at the other end and interposing elastomeric bodies between the structures about the bolt, between the nuts and the support structure, and in the holes of larger diameter in the support structure about the portions of the bolts extending therethrough.

20. An isolation fastener substantially as herein described with reference to and as illustrated by Figures 2 to 4 of the accompanying drawing.

21. A system for securing parts in isolation from each other substantially as herein described with reference to and as illustrated by the accompanying drawing.

22. A method for securing parts together in isolation from each other substantially as herein described with reference to and as illustrated by the accompanying drawing.